

10/574292

IAP20 Rec'd PCT TO 31 MAR 2006
PATENT

Attorney Docket No.: 42P21033

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Yuanhao Sun, et al

Application No.: Not Yet Assigned
(US National Phase filing of
PCT/CN2005/000265 under 35 U.S.C. 371)

Examiner: Not Yet Assigned

Art Unit: Not Yet Assigned

Filed: Herewith

For: ASYNCHRONOUS NETWORK STACK
OPERATION IN AN OPERATING SYSTEM
INDEPENDENT ENVIRONMENT

Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CLAIM FOR PRIORITY

Dear Sir:

Applicants hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT

EXPRESS MAIL STATEMENT

Express Mail Label No.: EV 841 073 914 US

Date of Deposit: 3-31-06

I hereby state that I am causing this paper or fee to be deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated above and that this paper or fee has been addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450

Teresa Joenks

Teresa Joenks

3-31-06

(Signature of person mailing paper or fee)

(Typed or printed name of person mailing paper or fee)

(Date Signed)

10/574292

IAP20 Rec'd FUT/PTO 31 MAR 2006

international application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

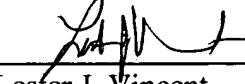
| Prior Foreign Application Nos. | Country | Foreign Filing Date (MM/DD/YYYY) | Priority Claimed? | Certified Copy Attached? |
|--------------------------------|---------|----------------------------------|-------------------|--------------------------|
| PCT/CN2005/000265 | PCT | 03/05/2005 | YES | YES |
| | | | | |

If there are any charges not covered by any check submitted, please charge Deposit
Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: March 31, 2006



Lester J. Vincent
Reg. No. 31,460

12400 Wilshire Blvd., 7th Floor
Los Angeles, CA 90025
Phone (408) 720-8300
Fax (408) 720-8383

4352042

证 明
AP20 Recd FINTO 31 MAR 2006

CERTIFICATE

本证明之附件是向中国专利局作为受理局提交的下列国际申请副本
S TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY OF THE BELOW
NTIFIED INTERNATIONAL APPLICATION THAT WAS FILED WITH THE
CHINESE PATENT OFFICE AS RECEIVING OFFICE

申请号: PCT/CN2005/000265

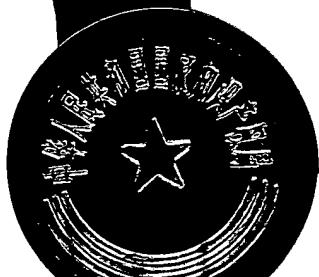
INTERNATIONAL APPLICATION NUMBER

申请日: 05.MAR2005(05.03.2005)

INTERNATIONAL FILING DATE

名称: ASYNCHRONOUS NETWORK STACK OPERATION IN AN
INVENTION OPERATING SYSTEM

CERTIFIED COPY OF
PRIORITY DOCUMENT



中华人民共和国国家知识产权局局长
COMMISSIONER OF THE STATE INTELLECTUAL PROPERTY
OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA

何力善

二零零五年十二月三十日

DECEMBER 30, 2005

Best Available Copy

HOME COPY

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT/CN2005 / 000265
International Application No.

05 · MAR 2005 (05 · 03 · 2005)
International Filing Date

RO/CN 中华人民共和国国家知识产权局
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) FPEL05150007

Box No. I TITLE OF INVENTION
ASYNCHRONOUS NETWORK STACK OPERATION IN AN OPERATING SYSTEM
INDEPENDENT ENVIRONMENT

Box No. II APPLICANT

This person is also inventor

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

INTEL CORPORATION
2200 Mission College Blvd.
Santa Clara, California 95052
United States of America

Telephone No.

Facsimile No.

Teleprinter No.

Applicant's registration No. with the Office

State (that is, country) of nationality:
USState (that is, country) of residence:
US

This person is applicant all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SUN, Yuanhao
N26 Apt 402, Lane 26
Gu Jing Road
Shanghai 200336
P. R. of China

This person is:

 applicant only applicant and inventor inventor only (If this check-box is marked, do not fill in below.)

Applicant's registration No. with the Office

State (that is, country) of nationality:
CNState (that is, country) of residence:
CN

This person is applicant all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

 agent common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

China Patent Agent (H.K.) Ltd.
22/F, Great Eagle Centre
23 Harbour Road, Wanchai
Hong Kong Special Administrative Region
The People's Republic of China

Telephone No.

(852)28284688

Facsimile No.

(852)28271018

Teleprinter No.

Agent's registration No. with the Office

Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

CONFIRMATION COPY

Sheet No. ... 2 ...

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

| | | |
|--|---|--|
| <p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>SONG, Caidong N181 Apt. 403, Tianshan Wu Cun, Maotai Road, Changning District, Shanghai 200000 P. R. of China</p> | | <p>This person is:</p> <p><input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p> |
| <p>State (that is, country) of nationality: CN</p> | <p>State (that is, country) of residence: CN</p> | |
| <p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p> | | |
| <p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>JIAN, Rui N5 Apt 301, Lane 1664 Xie Tu Road, Shanghai 200032 P. R. of China</p> | | <p>This person is:</p> <p><input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p> |
| <p>State (that is, country) of nationality:</p> | <p>State (that is, country) of residence:</p> | |
| <p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p> | | |
| <p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>DENG, Ying'an 9#202, Lane 560 Yu Ping South Road Shanghai, 200000 P. R. of China</p> | | <p>This person is:</p> <p><input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p> |
| <p>State (that is, country) of nationality:</p> | <p>State (that is, country) of residence:</p> | |
| <p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p> | | |
| <p>Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</p> <p>WANG, Zhi N430 Apt. 402, Dongyuan sicun, Shanghai, 200000 P. R. of China</p> | | <p>This person is:</p> <p><input type="checkbox"/> applicant only <input checked="" type="checkbox"/> applicant and inventor <input type="checkbox"/> inventor only (If this check-box is marked, do not fill in below.)</p> <p>Applicant's registration No. with the Office</p> |
| <p>State (that is, country) of nationality:</p> | <p>State (that is, country) of residence:</p> | |
| <p>This person is applicant for the purposes of: <input type="checkbox"/> all designated States <input type="checkbox"/> all designated States except the United States of America <input checked="" type="checkbox"/> the United States of America only <input type="checkbox"/> the States indicated in the Supplemental Box</p> | | |
| <p><input type="checkbox"/> Further applicants and/or (further) inventors are indicated on another continuation sheet.</p> | | |

Sheet No. 3

Box No. V DESIGNATIONS

The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.

However,

- DE Germany is not designated for any kind of national protection
- KR Republic of Korea is not designated for any kind of national protection
- RU Russian Federation is not designated for any kind of national protection

(The check-boxes above may be used to exclude (irrevocably) the designations concerned in order to avoid the ceasing of the effect, under the national law, of an earlier national application from which priority is claimed. See the Notes to Box No. V as to the consequences of such national law provisions in these and certain other States.)

Box No. VI PRIORITY CLAIM

The priority of the following earlier application(s) is hereby claimed:

| Filing date of earlier application (day/month/year) | Number of earlier application | Where earlier application is: | | |
|---|----------------------------------|--|--|--|
| | | national application: country or Member of WTO | regional application: regional Office | international application: receiving Office |
| item (1) | | | | |
| item (2) | | | | |
| item (3) | | | | |

- Further priority claims are indicated in the Supplemental Box.

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (*only if the earlier application was filed with the Office which for the purposes of this international application is the receiving Office*) identified above as:

- all items
- item (1)
- item (2)
- item (3)
- other, see Supplemental Box

* Where the earlier application is an ARIPO application, indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed (Rule 4.10(b)(ii)):

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / CN

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year) Number Country (or regional Office)

Box No. VIII DECLARATIONS

The following declarations are contained in Boxes Nos. VIII (i) to (v) (mark the applicable check-boxes below and indicate in the right column the number of each type of declaration):

Number of declarations

- | | | |
|---|--|---|
| <input type="checkbox"/> Box No. VIII (i) | Declaration as to the identity of the inventor | : |
| <input type="checkbox"/> Box No. VIII (ii) | Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent | : |
| <input type="checkbox"/> Box No. VIII (iii) | Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application | : |
| <input type="checkbox"/> Box No. VIII (iv) | Declaration of inventorship (only for the purposes of the designation of the United States of America) | : |
| <input type="checkbox"/> Box No. VIII (v) | Declaration as to non-prejudicial disclosures or exceptions to lack of novelty | : |

Sheet No. 4 ..

Box No. IX CHECK LIST; LANGUAGE OF FILING

| | | | | |
|--|---|--|--|-----------------|
| This international application contains: | | This international application is accompanied by the following item(s) (mark the applicable check-boxes below and indicate in right column the number of each item): | | Number of items |
| (a) in paper form, the following number of sheets: | | | | |
| request (including declaration sheets) | : 4 | <input checked="" type="checkbox"/> fee calculation sheet | | : 1 |
| description (excluding sequence listing and/or tables related thereto) | : 12 | <input type="checkbox"/> original separate power of attorney | | : |
| claims | : 5 | <input type="checkbox"/> original general power of attorney | | : |
| abstract | : 1 | <input type="checkbox"/> copy of general power of attorney; reference number, if any: | | : |
| drawings | : 5 | <input type="checkbox"/> statement explaining lack of signature | | : |
| Sub-total number of sheets | 27 | <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): | | : |
| sequence listing | | <input type="checkbox"/> translation of international application into (language): | | : |
| tables related thereto | | <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material | | : |
| (for both, actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (c) below) | | <input type="checkbox"/> sequence listing in computer readable form (indicate type and number of carriers) | | : |
| Total number of sheets | 27 | (i) <input type="checkbox"/> copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application) | | : |
| (b) <input type="checkbox"/> only in computer readable form (Section 801(a)(i)) | | (ii) <input type="checkbox"/> (only where check-box (b)(i) or (c)(i) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter | | : |
| (i) <input type="checkbox"/> sequence listing | | (iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the sequence listing mentioned in left column | | : |
| (ii) <input type="checkbox"/> tables related thereto | | | | |
| (c) <input type="checkbox"/> also in computer readable form (Section 801(a)(ii)) | | 10. <input type="checkbox"/> tables in computer readable form related to sequence listing (indicate type and number of carriers) | | : |
| (i) <input type="checkbox"/> sequence listing | | (i) <input type="checkbox"/> copy submitted for the purposes of international search under Section 802(b-quarter) only (and not as part of the international application) | | : |
| (ii) <input type="checkbox"/> tables related thereto | | (ii) <input type="checkbox"/> (only where check-box (b)(ii) or (c)(ii) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quarter) | | : |
| Type and number of carriers (diskette, CD-ROM, CD-R or other) on which are contained the | | (iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column | | : |
| <input type="checkbox"/> sequence listing: | | 11. <input type="checkbox"/> other (specify): | | : |
| <input type="checkbox"/> tables related thereto: | | | | |
| (additional copies to be indicated under items 9(ii) and/or 10(ii), in right column) | | | | |
| Figure of the drawings which should accompany the abstract: | Language of filing of the international application: EN | | | |

Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).



For receiving Office use only

| | | | |
|---|---|--|--|
| 1. Date of actual receipt of the purported international application: | 05 · MAR 2005 (05 · 03 · 2005) | | 2. Drawings: |
| 3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application: | | | <input type="checkbox"/> received: <input type="checkbox"/> not received: |
| 4. Date of timely receipt of the required corrections under PCT Article 11(2): | | | |
| 5. International Searching Authority (if two or more are competent): ISA / | 6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid | | |

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

This sheet is not part of and does not count as a sheet of the international application.

PCT

FEE CALCULATION SHEET Annex to the Request

For receiving Office use only

PCT/CN 2005 / 0 0 0 2 6 5
International Application No.

0 5 · MAR 2005 (0 5 · 0 3 · 2 0 0 5)

Date stamp of the receiving Office

Applicant's or agent's
file reference

FPEL05150007

Applicant
INTEL CORPORATION etc.

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE

CNY500

T

2. SEARCH FEE

CNY1500

S

International search to be carried out by CN

(If two or more International Searching Authorities are competent to carry out the international search, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FILING FEE

Where items (b) and/or (c) of Box No. IX apply, enter Sub-total number of sheets }
Where items (b) and (c) of Box No. IX do not apply, enter Total number of sheets }

27

i1 first 30 sheets

CHF1400

i1

i2

number of sheets
in excess of 30

fee per sheet

i2

i3 additional component (only if sequence listing and/or tables related thereto are filed in computer readable form under Section 801(a)(i), or both in that form and on paper, under Section 801(a)(ii)):

400 x fee per sheet = i3

Add amounts entered at i1, i2 and i3 and enter total at I

I

(Applicants from certain States are entitled to a reduction of 75% of the international filing fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the international filing fee.)

4. FEE FOR PRIORITY DOCUMENT (if applicable)

P

CNY 2200

5. TOTAL FEES PAYABLE

CNY2000CHF1400

TOTAL

CHF 1400

MODE OF PAYMENT

authorization to charge
deposit account (see below)

postal money order

cash

coupons

cheque

bank draft

revenue stamps

other (specify):

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT

(This mode of payment may not be available at all receiving Offices)

Authorization to charge the total fees indicated above.

(This check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit) Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.

Authorization to charge the fee for priority document.

Receiving Office: RO/

Deposit Account No. #

Date: 03/05/2005

Name: *

Signature: *

See Notes to the fee calculation sheet

ASYNCHRONOUS NETWORK STACK OPERATION IN AN OPERATING
SYSTEM INDEPENDENT ENVIRONMENT

TECHNICAL FIELD

[0001] Embodiments of the invention relate to network stack operation.

More particularly, embodiments of the invention relate to uses of an asynchronous network stack that may be used in an operating system independent (e.g., pre-boot) environment.

BACKGROUND

[0002] The pre-boot environment of an electronic device may be used for remote boot and/or remote installation purposes, which may require the electronic device to download one or more files from a remote server before control of the electronic device is passed to an operating system. In the pre-boot execution environment (PXE), the electronic device may receive one or more files from one or more remote servers. However, as the number of files downloaded increases and/or the functionality of the PXE increases, the current synchronous interface for packet transmission and receipt may become a bottleneck to system performance. Thus, current techniques for uploading and downloading of data in the PXE do not provide optimal performance.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings in which like reference numerals refer to similar elements.

Figure 1 is a conceptual block diagram of one embodiment of an asynchronous network stack that operates using a token.

Figure 2 is a block diagram of one embodiment of an embedded firmware agent.

Figure 3 is a conceptual flow diagram of one embodiment of a token passing sequence between layers in an asynchronous network stack.

Figure 4 is a conceptual flow diagram of one embodiment of a sequence between layers in an asynchronous network stack to cancel a previously requested/scheduled operation using a token.

Figure 5 is a block diagram of one embodiment of an electronic system.

DETAILED DESCRIPTION

[0003] In the following description, numerous specific details are set forth. However, embodiments of the invention may be practiced without these specific details. In other instances, well-known circuits, structures and techniques have not been shown in detail in order not to obscure the understanding of this description.

[0004] Described herein are techniques for asynchronous network stack operation in an operating system independent environment. In one embodiment, the asynchronous operation may be supported by a token-based stack design that may be used for network communications in the pre-boot environment, or any operating system independent environment. The techniques provide an asynchronous calling framework for network stack drivers that represent various operational layers. In one embodiment, the driver actions (e.g., transmit, receive) are schedulable.

[0005] Described herein are techniques for use of a token to support operation of the asynchronous network stack. In one embodiment, the token may have the following four characteristics: 1) the token may identify a requested action (e.g., to transmit a data packet, to receive a data packet), 2) a status indicator to indicate the current phase of the token or the result of the request, 3) an event to provide notification of a status change, and 4) a context. In alternate embodiments, additional and/or different token characteristics may be supported.

[0006] Figure 1 is a conceptual block diagram of one embodiment of an asynchronous network stack that operates using a token. The conceptual block diagram of Figure 1 includes specific network layers and protocols; however, in alternate embodiments different protocols and/or layers may be supported.

[0007] In one embodiment, the physical implementation of each network layer may be configured to communicate with embedded firmware agent 190. In alternate embodiments, one or more of the layers may not be configured to communicate with embedded firmware agent 190. Application 100 may represent any type of application, whether under operating system control or not, that includes functionality to communicate over a network external to the host device. Application 190 may be any type of application known in the art.

[0008] In one embodiment, Application 190 may request services, for example, transmission of a network packet, by passing a token to Multicast Trivial File Transfer Protocol layer 110. In general, TFTP is a transfer protocol that is simpler to use than the File Transfer Protocol (FTP), but provides less functionality. For example, TFTP does not support user authentication or directory visibility. TFTP uses the User Datagram Protocol (UDP) rather than the Transmission Control Protocol (TCP). One embodiment of TFTP is described formally in Request for Comments (RFC) 1350, Rev. 2, published July 1992.

[0009] TFTP has been expanded to include a multicast option as described in RFC 2090, published February 1997. Multicast TFTP classifies client devices as active clients or passive clients. There is only one active client at a time. The

active client communicates with a server to download data using a stop-and-wait ARQ flow and error control technique to a negotiated group address. When the requested activity has been accomplished, MTFTP layer 110 returns an event notification with the token requesting the activity. Use of the token and the event notification may allow application 190 to continue operation and engage in other tasks during the time required to accomplish the requested activity.

[0010] In one embodiment, the token passing technique may be employed between each network stack layer. That is, between MTFTP layer 110 and UDP layer 120, between UDP layer 120 and IP layer 130, between IP layer 130 and Managed Network Protocol (MNP) layer 140, and between MNP layer 140 and NIC driver 150.

[0011] In one embodiment, MTFTP layer 110, UDP layer 120, IP layer 130 and MNP layer 140 may represent layered network drivers. In a synchronous network stack, the calling layer will halt operation while the called layer performs the requested operation. In contrast, using the asynchronous network stack techniques described herein, a layer may request an operation from a lower layer using a token and perform operations not dependent upon the requested operation while the operation is being performed by the lower layer.

[0012] For example, IP layer 130 may request a received IP packet and may prepare a receive token and an associated notify event. After passing the receive token to MNP layer 140, IP layer 130 may engage in other operations, for example, preparation of a packet for transmission. When a packet is received

from the network and processed by MNP layer 240, the received packet may be stored and MNP layer 240 may notify IP layer 140 of the received packet via an event with token received from IP layer 140. In response to the event, IP layer 140 may process the received packet.

[0013] In one embodiment, embedded firmware agent 190 may allow the asynchronous network stack to operate in an operating system independent environment. **Figure 2** is a block diagram of one embodiment of an embedded firmware agent. In the example of Figure 2 the embedded firmware agent may have an interface compliant with an Extensible Firmware Interface (EFI) as defined by the EFI Specifications, version 1.10, published November 26, 2003, available from Intel Corporation of Santa Clara, California. In alternate embodiments, other firmware components can also be used.

[0014] In one embodiment, the embedded firmware agent may include agent bus 200 coupled with system interface 205. System interface 205 may provide an interface through which the embedded firmware agent communicates with the host system. The embedded firmware agent may further include agent network interface 250 that may be coupled with an external network (not shown in Figure 2) to allow the embedded firmware agent to communicate with a remote electronic device. Agent network interface 250 may support wired and/or wireless network communications.

[0015] In one embodiment, the embedded firmware agent further includes dynamic memory 210 that may be coupled with agent bus 200. Dynamic

memory 210 may provide storage for instructions and/or data to be used during operation. The embedded firmware agent may further include non-volatile storage 220 that may be coupled with agent bus 200 to store static data and/or instructions. In one embodiment, the embedded firmware agent may include control circuitry 230 coupled with agent bus 200 that may perform control operations and/or execute instructions provided by dynamic memory 210 and/or non-volatile storage 220.

[0016] In one embodiment, the embedded firmware agent may support operations that are independent of the host operating system. These operations may be, for example, pre-boot operations that are performed prior to the operating system being loaded, or while the operating system is being loaded, but prior to transfer of control to the operating system. These operations may also be independent of the host operating system when the host operating system has control of the host electronic device. For example, in one embodiment, the embedded firmware agent may be coupled with a host processor via an interrupt interface with, for example, the SMI pin of a Pentium® processor or with the PMI pin of an Itanium® processor (generically, xMI line). Other system interrupt signals may be used for other processors.

[0017] Because use of tokens as described herein may allow layer operations to be schedulable, parallel technology including, for example, hyperthreading, multi-processor systems and multi-threading may be incorporated into the firmware level design and allow stack drivers to perform parallel operations.

With use of, for example, an interrupt or a timer, an embedded firmware agent may interact with the asynchronous network stack to enable network operations including, for example, a background web server or a background telnet server, to be supported in a pre-boot or operating system independent environment. Use of status and/or context that may be supported by the token may allow network stack layers to communicate status without use of other channels as may be required by synchronous stack configurations.

[0018] **Figure 3** is a conceptual flow diagram of one embodiment of a token passing sequence between layers in an asynchronous network stack. In one embodiment, the upper network stack may generate or prepare a token to request a specific operation (e.g., transmission or receipt of a packet). In one embodiment, the token may include a notify event and/or contextual information that may be used to communicate status or context of the requested operation. In one embodiment, the upper stack layer may call a method or function of the lower stack layer to pass the token to the lower stack layer.

[0019] In response to receiving the token, the lower stack layer may perform and/or schedule the operation requested (e.g., transmit, receive) with the token. Upon completion of the requested operation, the lower stack layer may generate or prepare a signal event that communicates the completion of the requested operation to the embedded firmware agent. In one embodiment, the embedded firmware agent may notify the upper stack layer of completion of the requested operation with an event notification. In response to receiving the event

notification, the upper stack layer may perform any operation completion handling and delete the token.

[0020] **Figure 4** is a conceptual flow diagram of one embodiment of a sequence between layers in an asynchronous network stack to cancel a previously requested/scheduled operation using a token. In one embodiment, the upper network stack may generate or prepare a cancel request to cancel a previously generated token. In one embodiment, the cancel request may include the token and/or contextual information that may be used to communicate status or context of the token.

[0021] In one embodiment, the upper stack layer may call a method or function of the lower stack layer to pass the cancel request to the lower stack layer. In response to receiving the cancel request, the lower stack layer may abort the previous operation identified by the token and then generate or prepare a signal event to embedded firmware agent. In one embodiment, the embedded firmware agent may transmit a dispatch event signal to the upper stack layer, which may cause the upper stack layer to perform any error handling and delete the token.

[0022] In one embodiment, the techniques of Figures 3 and 4 can be implemented as instructions executed by an electronic system. The instructions may be stored by the electronic device or the instructions can be received by the electronic device (e.g., via a network connection). **Figure 5** is a block diagram of one embodiment of an electronic system. The electronic system illustrated in

Figure 5 is intended to represent a range of electronic systems, for example, computer systems, network access devices, etc. Alternative systems, whether electronic or non-electronic, can include more, fewer and/or different components. The electronic system of Figure 5 may represent a server device as well as the one or more client devices.

[0023] Electronic system 500 includes bus 505 or other communication device to communicate information, and processor 510 coupled to bus 505 to process information. While electronic system 500 is illustrated with a single processor, electronic system 500 can include multiple processors and/or co-processors. Electronic system 500 further includes random access memory (RAM) or other dynamic storage device 520 (referred to as memory), coupled to bus 505 to store information and instructions to be executed by processor 510. Memory 520 also can be used to store temporary variables or other intermediate information during execution of instructions by processor 510.

[0024] Electronic system 500 also includes read only memory (ROM) and/or other static storage device 530 coupled to bus 505 to store static information and instructions for processor 510. In one embodiment, static storage device 530 may include an embedded firmware agent. In alternate embodiments, other firmware components can also be used.

[0025] Data storage device 540 is coupled to bus 505 to store information and instructions. Data storage device 540 such as a magnetic disk or optical disc and corresponding drive can be coupled to electronic system 500.

[0026] Electronic system 500 can also be coupled via bus 505 to display device 550, such as a cathode ray tube (CRT) or liquid crystal display (LCD), to display information to a user. Alphanumeric input device 560, including alphanumeric and other keys, is typically coupled to bus 505 to communicate information and command selections to processor 510. Another type of user input device is cursor control 570, such as a mouse, a trackball, or cursor direction keys to communicate direction information and command selections to processor 510 and to control cursor movement on display 550. Electronic system 500 further includes network interface 580 to provide access to a network, such as a local area network. Network interface 580 may further include one or more antennae 585 to provide a wireless network interface according to any protocol known in the art.

[0027] Instructions are provided to memory from a storage device, such as magnetic disk, a read-only memory (ROM) integrated circuit, CD-ROM, DVD, via a remote connection (e.g., over a network via network interface 580) that is either wired or wireless providing access to one or more electronically-accessible media, etc. In alternative embodiments, hard-wired circuitry can be used in place of or in combination with software instructions. Thus, execution of sequences of instructions is not limited to any specific combination of hardware circuitry and software instructions.

[0028] An electronically-accessible medium includes any mechanism that provides (i.e., stores and/or transmits) content (e.g., computer executable

instructions) in a form readable by an electronic device (e.g., a computer, a personal digital assistant, a cellular telephone). For example, a machine-accessible medium includes read only memory (ROM); random access memory (RAM); magnetic disk storage media; optical storage media; flash memory devices; electrical, optical, acoustical or other form of propagated signals (e.g., carrier waves, infrared signals, digital signals); etc.

[0029] Reference in the specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[0030] While the invention has been described in terms of several embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described, but can be practiced with modification and alteration within the spirit and scope of the appended claims. The description is thus to be regarded as illustrative instead of limiting.

CLAIMS

What is claimed is:

1. A method comprising:

sending a request for a first network operation from a first network stack layer to a second network stack layer using a token-based asynchronous inter-layer communication protocol in an operating system independent environment; performing, with the first network stack layer, a second network operation prior receiving an indication of completion of the first network operation; and sending the indication of completion of the first network operation from the second network stack layer to the first network stack layer via an embedded firmware agent in response to completion of the first network operation.

2. The method of claim 1 wherein the first network stack operation comprises a data transmission operation.

3. The method of claim 1 wherein the first network stack operation comprises receipt of data via a network connection.

4. The method of claim 1 wherein the operating system independent environment comprises a pre-boot execution environment.

5. The method of claim 1 wherein the first network stack layer and the second network stack layer are both communicatively coupled with an embedded firmware agent in a host system that supports the asynchronous token-based network stack.
6. The method of claim 1 wherein the indication of completion includes at least the token.
7. An apparatus comprising:
an embedded firmware agent capable of functioning in an operating system independent manner;
control circuitry to support a token-based asynchronous inter-layer communication protocol communicatively coupled with the embedded firmware agent to send a request for a first network operation from an upper network stack layer to a lower network stack layer using a request including a token, performing, with the upper network stack layer, a second network operation prior receiving an indication of completion of the first network operation, and send the indication of completion of the first network operation from the second network stack layer to the first network stack layer via an embedded firmware agent in response to completion of the first network operation.

8. The apparatus of claim 7 wherein the first network stack operation comprises a data transmission operation.

9. The apparatus of claim 7 wherein the first network stack operation comprises receipt of data via a network connection.

10. The apparatus of claim 7 wherein the operating system independent environment comprises a pre-boot execution environment.

11. The apparatus of claim 7 wherein the indication of completion includes at least the token.

12. An article comprising a computer-readable medium having stored thereon instructions that, when executed, cause one or more processing components to:

send a request for a first network operation from a first network stack layer to a second network stack layer using a token-based asynchronous inter-layer communication protocol in an operating system independent environment;

perform, with the first network stack layer, a second network operation prior receiving an indication of completion of the first network operation; and

send the indication of completion of the first network operation from the second network stack layer to the first network stack layer via an embedded firmware agent in response to completion of the first network operation.

13. The article of claim 12 wherein the first network stack operation comprises a data transmission operation.

14. The article of claim 12 wherein the first network stack operation comprises receipt of data via a network connection.

15. The article of claim 12 wherein the operating system independent environment comprises a pre-boot execution environment.

16. The article of claim 12 wherein the indication of completion includes at least the token.

17. A system comprising:
one or more processing components;
a network interface coupled with the one or more processing components;
and
a computer-readable medium coupled with the one or more processing components having stored thereon instructions that, when executed, cause the one

or more processing components to send a request for a first network operation from a first network stack layer to a second network stack layer using a token-based asynchronous inter-layer communication protocol in an operating system independent environment, perform, with the first network stack layer, a second network operation prior receiving an indication of completion of the first network operation, and send the indication of completion of the first network operation from the second network stack layer to the first network stack layer via an embedded firmware agent in response to completion of the first network operation.

18. The system of claim 17 wherein the first network stack operation comprises a data transmission operation.

19. The system of claim 17 wherein the first network stack operation comprises receipt of data via a network connection.

20. The system of claim 17 wherein the operating system independent environment comprises a pre-boot execution environment.

ABSTRACT

Techniques for operation of an asynchronous stack in a pre-boot environment. A token-based stack design may be used to support communications between network stack layers.

AP

1/5

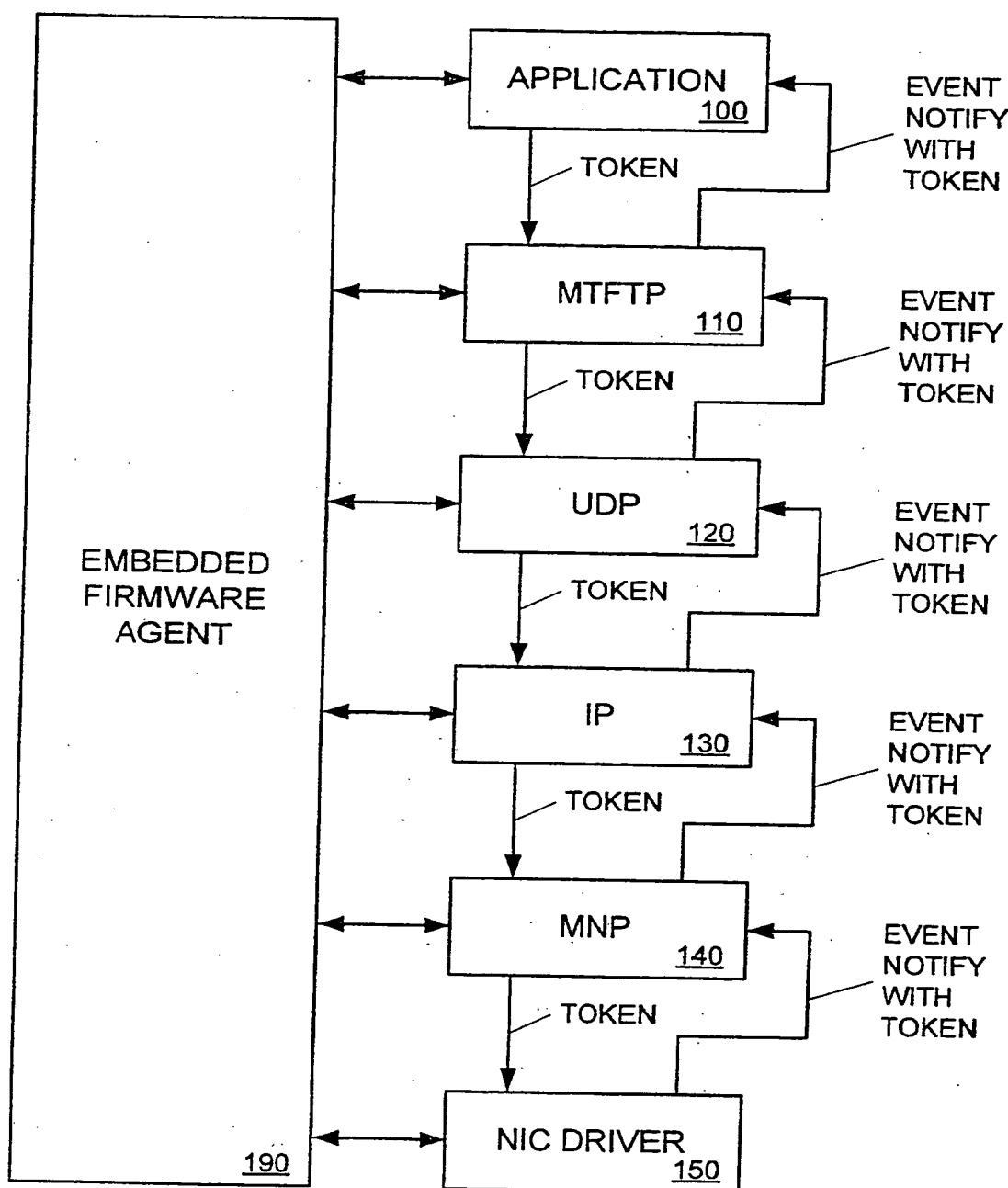


Fig. 1

2/5

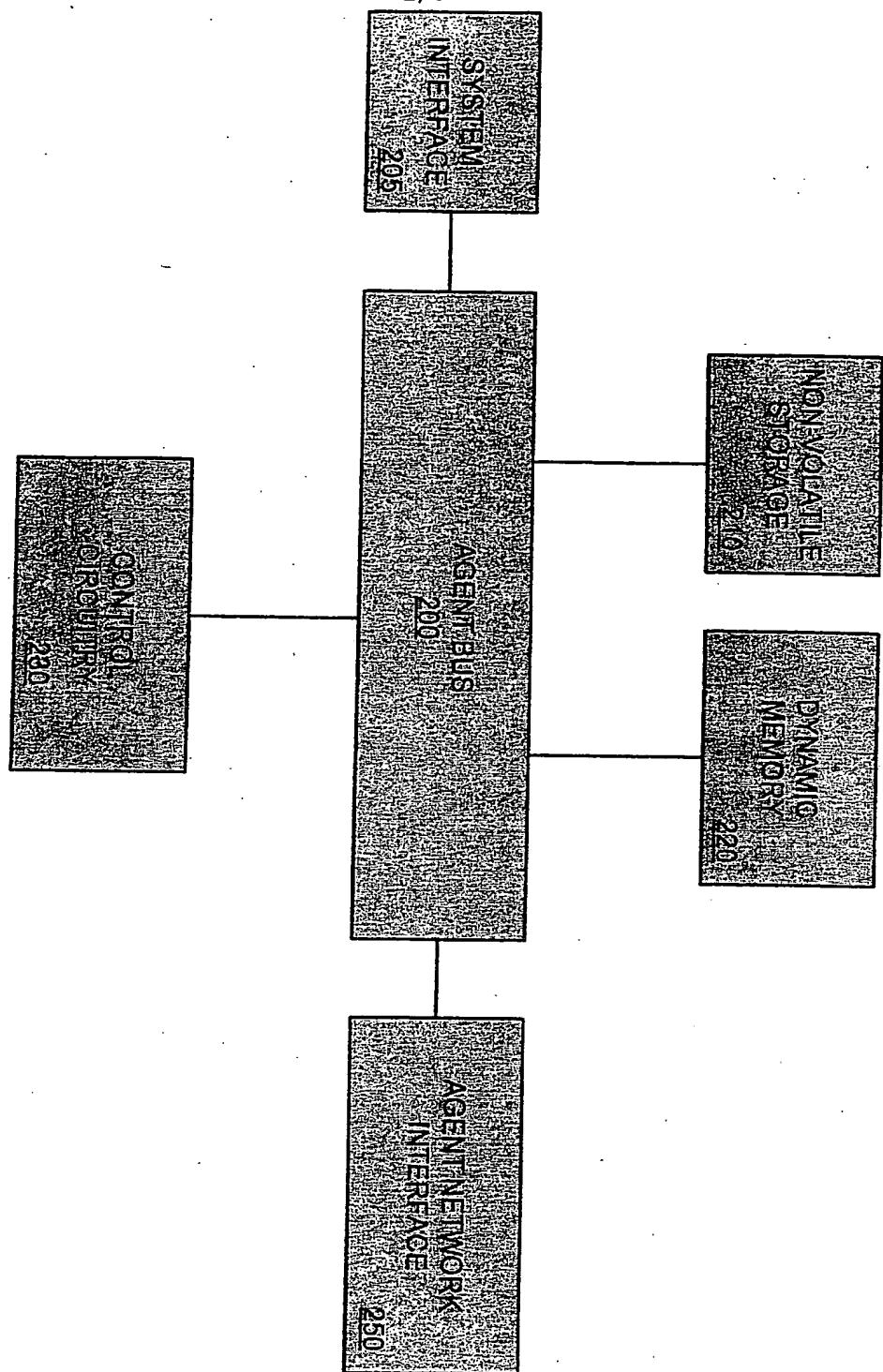


FIG. 2

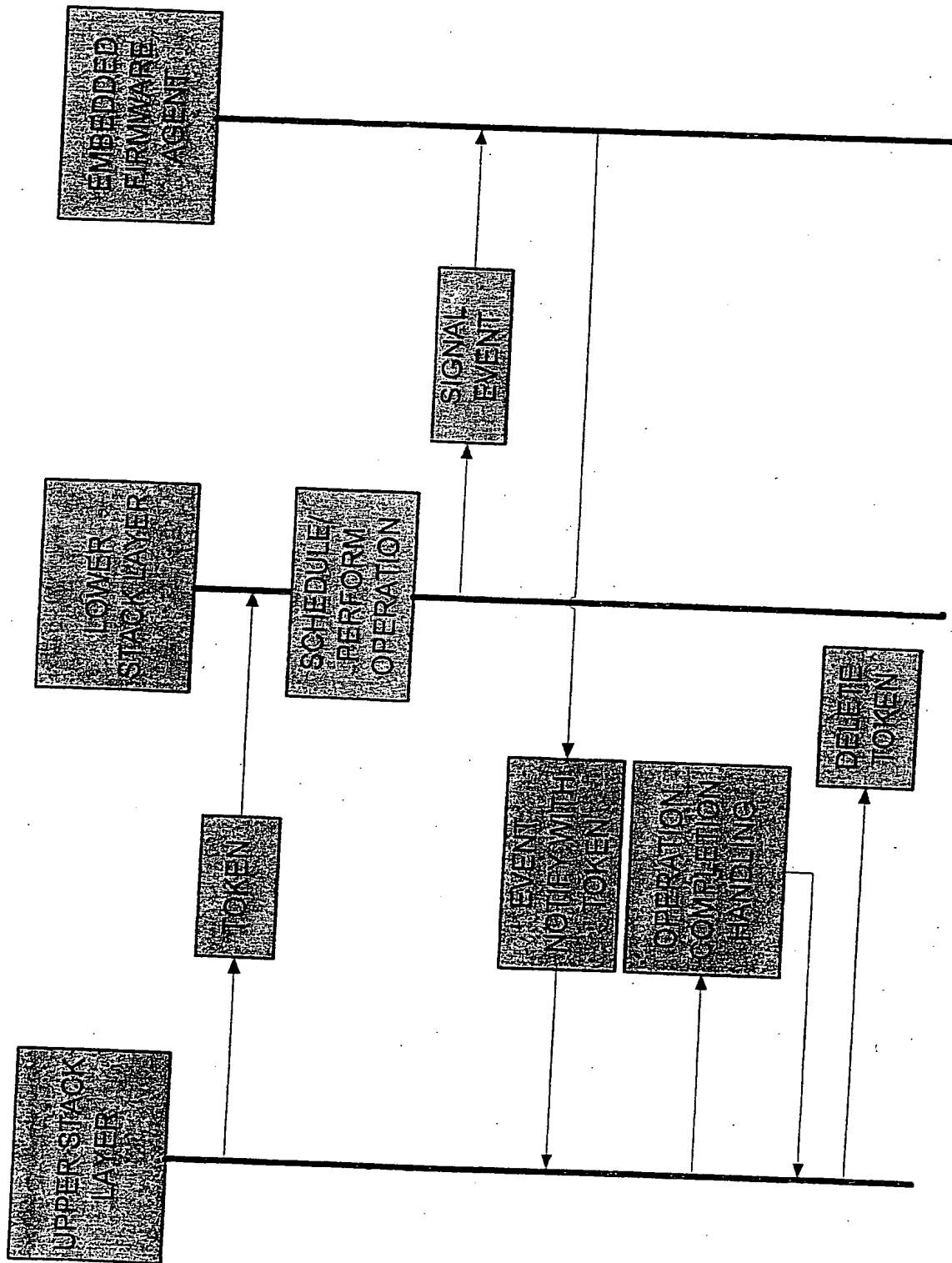


FIG. 3

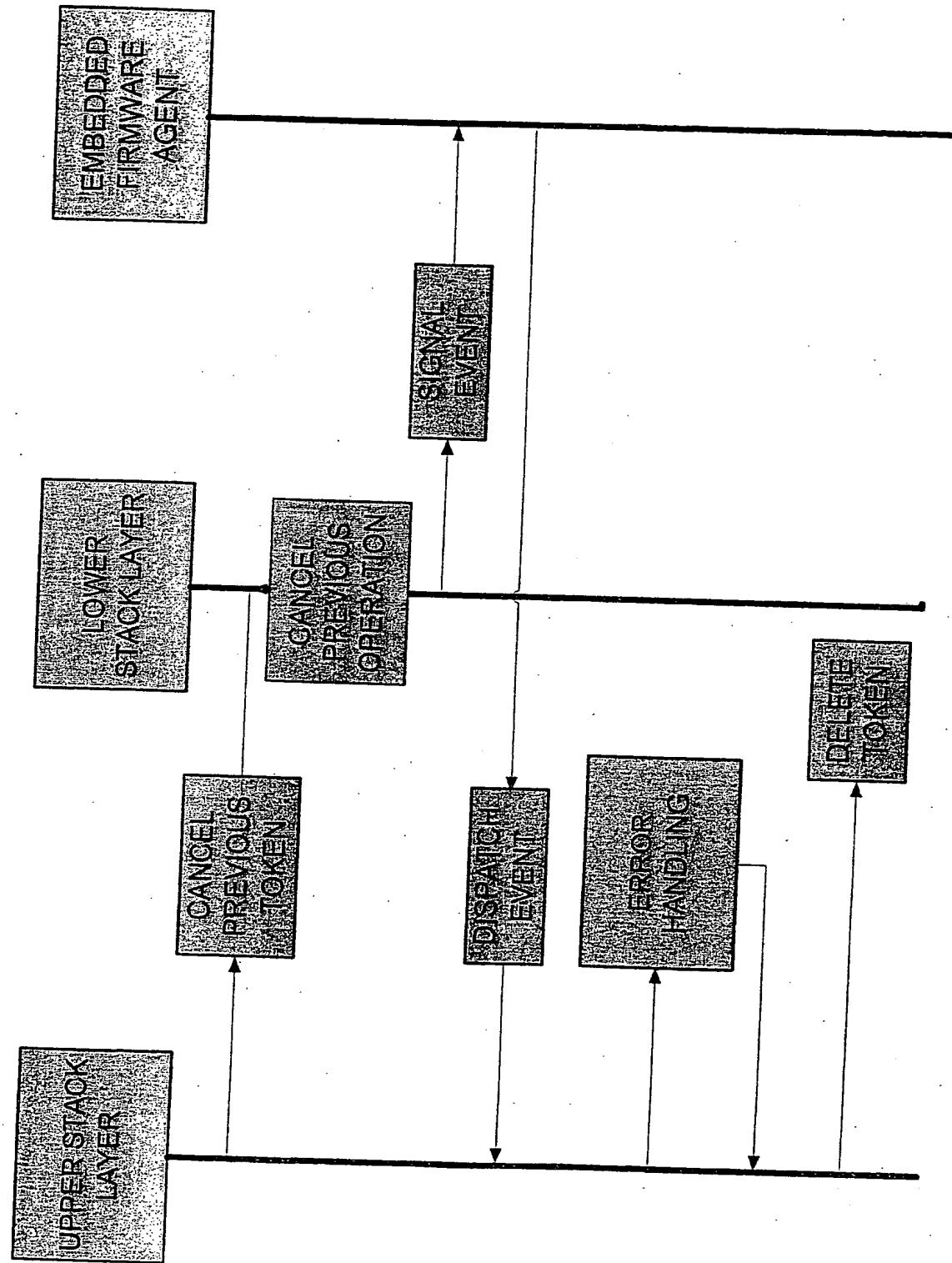
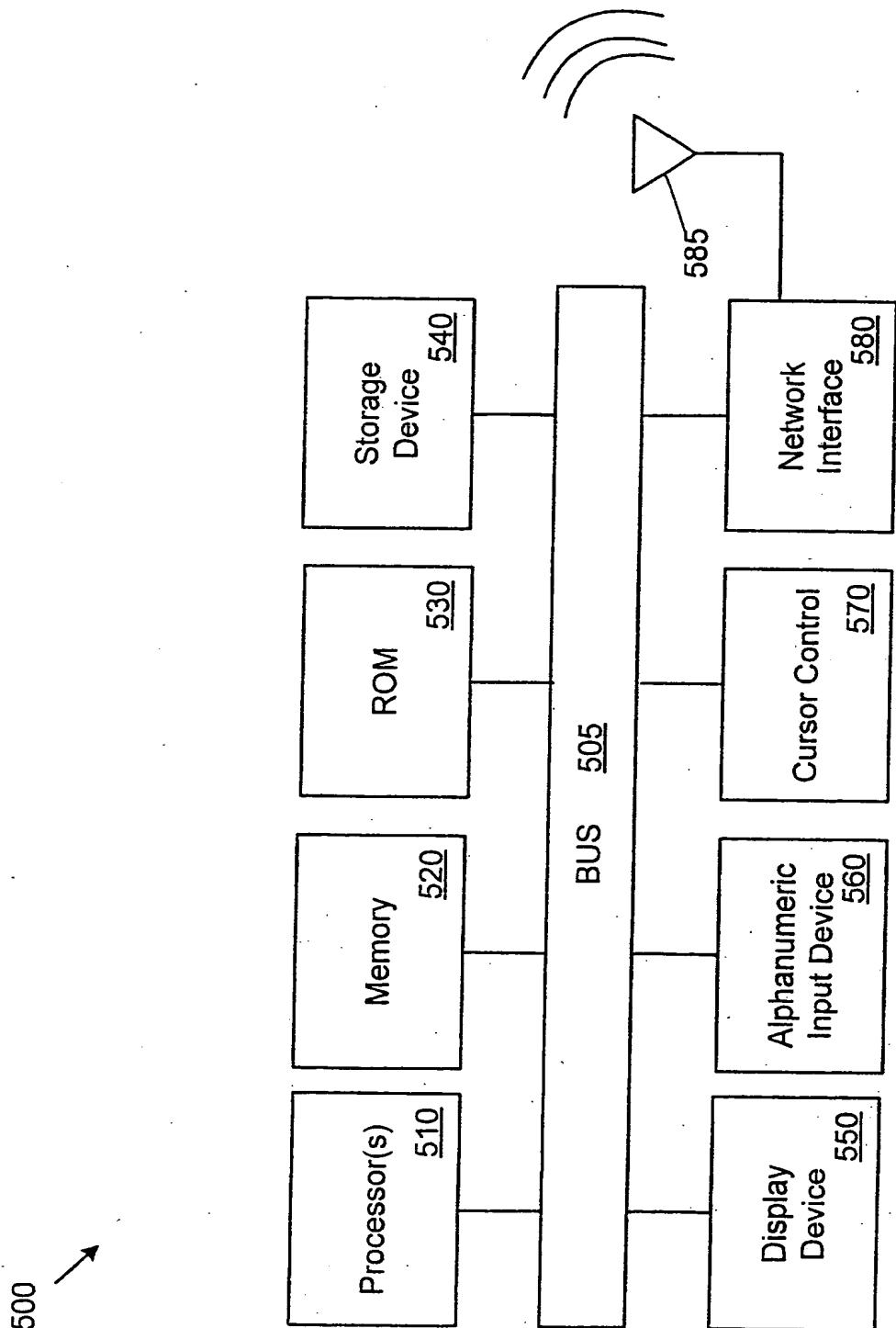


FIG. 4

**Fig. 5**

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.